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Assessing complications and cost-utilization in ventral hernia repair utilizing biologic mesh in a bridged underlay technique

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Abstract

BACKGROUND: The inability to reapproximate fascia in complex ventral hernia (CVH) repair remains challenging. Single-stage bridging reconstructions have been reported, however, with high rates of recurrence and wound complications. We describe a single-surgeon experience with bridging biologic CVH repair.

METHODS: We reviewed 37 patients undergoing CVH repair with bridging biologic mesh by the senior author from January 1, 2007 to January 1, 2013. Surgical history and operative characteristics were analyzed for predictors of hernia recurrence and wound complications.

RESULTS: Average age was 53 ± 15 years, body mass index was 31.1 ± 8.1 kg/m^2, and history of prior repair in 18 patients. Common indications were trauma, intra-abdominal infection, and prior intra-abdominal surgery. Incidence of wound complications was 51.4%, most commonly wound breakdown and infection. With average follow-up of 13 months, recurrence rate was 18.9% at an average of 8.2 months postoperatively. Analysis demonstrated postoperative wound infection as the only predictor of recurrence (odds ratio = 22.1, P = .017).

CONCLUSIONS: Hernia recurrence rate was 18.9% with bridged biologic CVH repairs, strongly associated with postoperative wound infection. This suggests that patients with postoperative infections may benefit from closer surveillance and more aggressive wound management.

While there is no explicit definition for complex ventral hernia (CVH), it represents a high-risk wound in a high-risk patient.[1,2] Bowel surgery, intra-abdominal infection, and the damage control laparotomy frequently result in such CVHs.[3] Multiple factors contribute to the high morbidity associated with operative repair of CVHs and challenge even the most experienced reconstructive surgeons. Obesity and diabetes are common patient comorbidities that can adversely impact

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wound healing, and prior abdominal surgeries can be a significant operative risk factor for wound complications.[3]

Prolonged loss of domain in patients with CVHs, in addition to tissue noncompliance and contractures from prior surgeries, may lead to the inability to achieve midline fascial closure. In the past, staged procedures were the only way to address this dilemma, but with advances in operative techniques and biomaterial development, we now have the opportunity to perform single-stage bridging reconstructions.[4,5] However, selecting which patients would benefit optimally from a bridged single-stage repair or a two-staged repair in the setting of a CVH with inability to achieve midline fascial closure remains unclear.[6] Considering recent literature demonstrating very high recurrence rates with single-staged biologic repairs, appropriate patient selection has become even more critical.

Compounding the absence of quality evidence-based models for patient selection is the lack of consensus regarding the choice of biologic mesh.[7–9] Synthetic mesh is relatively contraindicated in the contaminated setting, as well as in patients at high risk of adhesion formation.[10–13] As such, biologic meshes, including human-derived AlloDerm (LifeCell Corporation, Branchburg, NJ) and porcine-derived Permacol (Covidien, Norwalk, CT) have been most frequently studied in the setting of high-risk CVH repair. A recent meta-analysis of biologic mesh performance in CVH repair demonstrated lower rates of infection and seroma with Permacol mesh versus human-derived AlloDerm, but higher rates of subsequent hernia recurrence.[9] However, these conclusions were across both reinforced and bridged repairs, and definitive conclusions were not possible as studies involving a bridging repair were few and small in sample size. Finally, with the uncertainty of mesh performance in a bridged setting, cost becomes a relevant concern. AlloDerm costs approximately $35.31/cm^2, while porcine-derived meshes cost between $19.00 and 25.00/cm^2, an important consideration when superiority has not clearly been demonstrated for either mesh.[14]

The purpose of this study was to review the senior author's experience with bridged hernia repair utilizing biologic mesh. We summarize patient factors, operative characteristics, and outcomes with the hopes of refining patient selection to optimize outcomes and cost efficiency.

Methods

Study design

After obtaining appropriate institutional review board approval, a retrospective chart review was conducted of all patients undergoing CVH repair by the senior author from January 1, 2007 to January 7, 2013 within the University of Pennsylvania Health Systems. Patients were included who underwent CVH repair utilizing biologic mesh in a bridging technique. Patients were excluded if synthetic mesh was used, if the autologous fascia was primarily closed in the midline, if the skin was not closed primarily after repair, or if the repair was done in the setting of an open abdomen.

Operative approach

All hernias were repaired in the elective setting. After laparotomy and lysis of adhesions, bilateral skin and soft tissue flaps are developed overlying the abdominal wall lateral to the semilunar line. Provided there is sufficient tissue quality, anterior components separation is performed bilaterally or unilaterally in the presence of an ostomy. The biologic mesh is then selected and cut appropriately to the size of the defect, allowing for a minimum of 5 cm of overlap with native fascia in all directions. Initially, Permacol (Covidien) was placed in all patients because of institutional availability; however, with the more recent availability of SurgiMend (TEI Biosciences, Boston, MA) and XenMatrix (C. R. Bard/Davol, Inc, Warwick, RI) mesh, we have largely abandoned Permacol for either of the non–cross-linked constructs as the biologic mesh of choice at our institution. The mesh is placed in an intraperitoneal underlay position and secured with interrupted #1 Maxon U-stitches through the semilunar line for avoid making the medial edge of the rectus myofascial complex dysvascular. Typically, three #10 Jackson-Pratt drains are placed, followed by resection of devitalized skin and subcutaneous tissue to healthy bleeding wound edges. Scarpa's fascia is then reapproximated with interrupted #0 Vicryl sutures, deep dermal interrupted 3-0 Vicryl sutures are placed, and the skin closed with interrupted 2-0 Prolene vertical mattress sutures alternating with skin staples. Drains remain in place for approximately 7 to 10 days, or until output is less than 30 cc/day. We encourage all patients to have epidurals because in our experience, they provide for more optimal pain management postoperatively and reduce complication rates.[15]

Data collection

Demographic information, including age at repair, sex, body mass index (BMI) (kg/m^2), medical comorbidities, and prior surgical history, was collected. Details regarding prior abdominal hernias, repair type, and subsequent hospital course, including history of wound or mesh infection, were recorded when available. Hernias were classified based on the modified Ventral Hernia Working Group grading system.[16]

Operative characteristics were extracted from electronic medical records. The indication for operation and any concurrent intra-abdominal procedure was noted, in addition to defect size (cm^2), use of components separation, type of mesh, and operative length. A concurrent intra-abdominal procedure was defined as any procedure violating the gastrointestinal tract, such as bowel resection or ostomy takedown, but excluding lysis of adhesions. Perioperative anesthesia data were reviewed for American Society of Anesthesiology's physical status,[17] Centers for Disease Control wound classification,[18] laboratory values, intraoperative fluid and